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CANALS WHICH SERVE

BOTH FOR

Navigation and for Irrigation

REPORT

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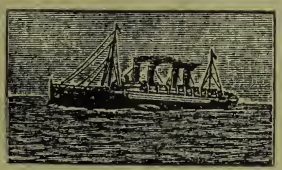
NAVIGARE  NECESSE

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Canals Useful in Navigation and Agriculture

One of the important questions in the development of the resources of the United States, as well as that of any other country where agriculture is prominent, is as to the possibility of combining various useful purposes in the construction of inland waterways. This is one of a number of related questions which has been referred by the President of the United States to an Inland Waterways Commission appointed in the spring of 1907. At this time it is not practical to discuss what may be the findings of this Commission ; but it is appropriate to consider some of the factors which enter into the problem.

The practicability of constructing canals for irrigation and drainage, and at the same time utilizing these for the transportation of the heavier farm products has been discust in a general way, but there is available very little direct information on the subject. It would seem at first sight as tho economy could be promoted by building a canal in such a manner that it can serve a variety of purposes. For example, it has been suggested that by providing adequate works of storage, water could be supplied to canals which could first be used at the upper part of their course in developing power. Second and later they could serve as burden carriers, and third, the water could ultimately be taken out upon the fields to irrigate these in times of drought ; or as a fourth use, the same conduits might serve to convey the excess water from marshes or overflowed areas. This theoretical gain of combining a number of functions has, however, in practise been offset by a number of difficulties which, up to the present time, rendered the construction of such canals in the United States practically impossible. Attempts have been made in a few instances to utilize for water-

power the canals built primarily for navigation, such for example, as the Erie Canal in the State of New-York. In other instances, canals built primarily for irrigation, as one of the large canals near the city of Salt Lake, Utah, has been used in the transportation of heavy materials, such as building stone. Again, canals built primarily for drainage of low lands on the coast of Louisiana have been used by smale boats bringing oysters and fish from the salt waters up to the inhabited areas. These uses have, however, been relatively small and almost insignificant, and have been what may be termed secondary considerations, or afterthoughts, the structures not being designed originally for the dual purpose.

The theoretical advantages of combining navigation with irrigation and drainage are obvious, namely, that the one waterway should serve all the purposes possible and should be able to transport the heavier articles or commodities, especially the farm products and fertilizers used for the field. On the first consideration of the subject these advantages seemed so manifestly obvious that wonder is at once exprest that there has not been a larger development of the navigation side of these public improvements.

On the other hand the practical disadvantages are such that a discussion of the subject of the use of canals for both purposes resolves itself largely into an anlysis of objections or of the reasons why the canals already built are not utilized or others are not built so that they can be utilized for navigation or for the other purposes named. These objections may be discust under several heads, as follows : —

a) Terminal facilities ;
b) Location of canals ;
c) Fluctuations of supply ;
d) Obstacles offered by structures.

Terminal facilities

Under this heading are grouped the discussion of obstacles which arise from the difficulty of bringing merchandise to the canal and taking it from the canal banks to the points where needed. To illustrate this point it is necessary merely to call attention to the facilities offered by rail transportation. Trains

of cars are made up of relatively small units which can be switched or diverted to points convenient for loading and unloading. The entire train is made up of these units and its progress may be only slightly affected by the delay of any one of these units.

in the case of navigation, however, the individual packets or units consist of boats which are, of course, far larger than the ordinary railroad car and hence the delay of any part of the load results in obstructing the movement of the boat as a whole.

To provide terminal facilities such that boats can receive, discharge, and distribute portions of their cargo requires, as a part of navigation, structures usually far more elaborate and difficult to maintain than the ordinary switches or side tracks of the railroads. These terminal facilities also can not be scattered over such broad areas. It is true they can extend along the line of the canal but this line is relatively narrow and is not susceptible of infinite branching realized in the case of railroad or wagon transportation.

Location of Canals

The location of a canal for irrigation or navigation is fixt by certain topographic conditions which as a rule bring it away from the lines of transportation of produce. The location of any waterway must, of course, be governed to a far larger extent by topography than is necessary for placing railroads, as the latter can ascend or descend gentle slopes and can tunnel thru obstructions or surmount them. The canals must be carried upon good grades and can not depart very widely from the contour laid down by nature. This fact fixes the location of the canal and in the cases where it is used for irrigation or drainage the range of location is still further limited by the fact that for irrigation water must be delivered to the higher portions of the land and for drainage the water must be taken from the lower portions.

To use an irrigation canal for transportation, it is necessary that goods be carried around or along the upper margin of the cultivated areas or along the ridges which intersect it. The larger portion of the canal or the trunk line lies for the great part in a region above or away from the main body of the agricultural lands, since the canal brings water from some river or

remote source. When the canal reaches the agricultural lands the division and subdivision of the water reduces the volume of flow to such an extent that the carrying capacity as regards navigation is diminished to a point where it is practically valueless.

Thus it results that in the portion of the canal where navigation would be most easy, viz., on the trunk line near the head where the volume of water is largest, there is usually very little demand for traffic. On the lower reaches of the canal and its branches which reach into the agricultural fields the transportation facilities are reduced by the smaller volume of water in the canal. The expense of bringing heavy crops to the canal banks or away from them, as above noted under the head of « Terminal Facilities », is frequently far greater than would be the cost of hauling the material by wagon or rail down the grade of the country towards lower levels. In other words, to reach the irrigation canal used for navigation the products of the soil must, as a rule, be hauled on an up-grade to reach the canal, and when once put upon the canal they must move mainly in an up-stream direction toward the source of water and frequently away from the centers of population.

There may be, and frequently are, conditions where population is upstream from the agricultural land and where it would seem that the heavy agricultural products could be taken in that direction. Where such conditions do exist, however, there has not yet been any considerable development of navigation and it appears probable that other objections have intervened where the conditions are otherwise favorable.

Considering drainage canals in the same way, the reverse condition is, to a certain extent, prevalent, the drainage canals starting in the agricultural areas in small drains do not obtain a size or magnitude sufficiently great to afford opportunities for navigation until the drainage has past outside of or beyond the agricultural area. The products of the agricultural area could be hauled down hill to the drainage canal, but the expense of then loading them upon the canal is generally greater than would be the case of continuing them upon the wagon or other means of conveyance to the railroad. As in the case of irrigation canals, the main bulk of the products must be loaded and moved away from the center of the agricultural area before it can reach navigable waters.

Flucutations of Supply

A more important detail, perhaps, than that of convenience of loading and unloading is the fact that the canals built for irrigation or drainage must be planned with consideration of maximum or minimum water supply. The maximum supply of water taken down the irrigation canal is usually called for during the early part of the crop season. At this time there is relatively little produce to be moved or necessity of transportation of fertilizers. At this time of high water, navigation would presumably be most easily accomplished. Later in the season, when the crops are ready for transportation, the water is as a rule turned out of the canals, and the water supply, if obtained from natural streams or event from storage reservoirs, is so greatly reduced that it is not practicable to maintain a full head in the canal.

In the case of drainage canals the conditions are somewhat reversed, in that the drainage from the fields may be very large in the spring, but tends to be reduced during the summer. By the time the crop season is over there is frequently a drought such that the drainage from the fields is not sufficient in volume to maintain navigation stages in the canal.

Structures

In planning canals for agriculture the structures are usually laid out with reference to the passage of water thru them in the most economical and effective manner. As a rule gates are employed, or underground passage or sluices placed in a position for safety or economy. If the canals are to be used for navigation, it is obvious that all such gates or sluices must be reconstructed as to permit the passage of boats, or auxiliary structures must be provided, such as locks, to pass the boats around the gates or other regulating devices. The cost of these locks or similar devices for maintaining an open waterway is often very great, far in excess of the cost of the regulating devices themselves. Bridges also must be movable, or placed at elevations sufficient to clear the boats.

In conclusion, it may be stated that for the reasons given above and because of local obstacles there do not appear to be in the United States or adjacent countries any notable canals where navigation is combined with direct application to agricultural purposes such as irrigation and drainage.

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